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METHOD AND DEVICE FOR THE PRODUCTION OF A PNEUMATIC TIRE RIM

The present invention relates to a method of producing a weight-optimized pneumatic tire rim according to the preamble of Claim 1 as well as to a device for implementing the method.

For producing such a pneumatic tire rim, it is known, for example, from German Patent Document DE-OS 26 47 464 to reduce the thickness of the outlet wall, thus that of the tube section, while simultaneously extending the length, on a longitudinally welded cylindrical tube section, which is also called a tire, by pressing on at least one rotating pressure roller or drawing roller in correspondence with a tool lining, which results in partially different wall thicknesses over rotational symmetrical areas, which wall thicknesses are defined by the function.

Thus, normally, the rim dish is welded together with the rim well in the area of a well base, for which the latter has to have a certain wall thickness.

Because of the required weight optimizations, the areas which, in contrast to the above-mentioned welding area, are subject to no special stress, should be constructed as thin as possible, so that the original wall thickness which, in the case of the finished pneumatic tire rim, exists only in the above-mentioned stressed areas, is correspondingly reduced by extrusion molding.

However, this is connected with a number of disadvantages. Thus, for example, several working steps are required for achieving the reduction of the wall thickness, which leads to relatively high manufacturing times and resulting high manufacturing costs.

In this case, it is a contributing factor that the edges of the flanks become "uneven" as a result of the extrusion, thus the drawing of the material; that is, an edge is created which, in the broadest sense, is frayed and requires a finishing.

Particularly in view of the fact that such pneumatic tire rims are produced as serial

products in large piece numbers, the above-mentioned disadvantages have a special significance.

It is therefore an object of the present invention to further develop a method of the above-mentioned type such that the manufacturing times are shortened and a more cost-effective manufacturing therefore becomes possible.

This object is achieved by means of a method which has the characteristics of Claim 1 as well as by means of a device having the characteristics of Claim 7.

As a result of the manufacturing, the tube section used as the blank has relatively large tolerances in its wall thickness which so far, during the extrusion to a defined wall thickness of the flanks, led to the above-mentioned unevenness of the edges.

In contrast, by means of the new method, an exact predefinable material volume is created which is available for the further machining of the flanks (longitudinal drawing, contouring and bringing to predefined wall thicknesses).

In this case, the longitudinal drawing, which is the result of the possibly partial reduction of the wall thickness carried out by means of pressure rollers, is preferably limited by a stop which is provided in a surrounding manner at the surface area of the tool lining and on which the respective flank rests in the end position, thus after the termination of the pressure rolling.

By means of the volume of the flanks, which is present in a defined manner after the pressure rolling, the length of the flanks after the termination of the deformation can also be determined while taking into account the desired wall thicknesses.

This allows not only a production of the rim well which is as precise as possible with respect to the measurements but the subsequent trimming of the edges can also be eliminated because, as a result of the....(something is missing in the German, translator) in the case of each rim well to be produced as a serial product, the same flank volumes exist after the first process step.

The excess material, which results from the thickness tolerances, is pushed into the well base zone during the leveling of the wall thickness, where it leads to a thickening of the wall.

Thus, as the initial wall thickness of the tube section, a wall thickness can be selected which is less than the end wall thickness in the area of the well base zone whose end thickness is, in turn, obtained from the original wall thickness and the added tolerance material of the flanks.

According to another idea of the invention, it is provided that, before the leveling of the wall thickness of the then still cylindrical wall section as an initial product, the latter is widened on at least one, preferably however, on both end sides.

In this case, the diameter of the cylindrical tube section is smaller than the largest outside diameter of the rim well to be produced by the subsequent machining steps, whereas the diameter of the tube section corresponds to the largest diameter of the rim well when the end-side widening is eliminated.

Since the material volume remains the same in each case, in the case of a smaller diameter of the used tube section, a larger width or wall thickness of the tube section is to be provided correspondingly.

The above-mentioned widening of the tube section has manufacturing-related advantages since, during the subsequent pressing for the contouring, an uncontrolled excursion of the end areas is prevented.

A device for implementing the method is constructed such that, for receiving the cylindrical tube section, a two-part tool lining is provided which is contoured at its outer surface area, the two tool lining parts being axially movable relative to one another.

Additional advantageous embodiments of the method as well as of the device are characterized in the subclaims.

The method according to the invention will be described again in the following by means of drawings which illustrate an embodiment of a device for implementing the method.

Figures 1 and 2 are longitudinal sectional views respectively of a device for implementing a first process step;

Figures 3 and 4 are also longitudinal sectional views respectively of another device for respectively following process steps;

Figure 5 is a schematic longitudinal sectional view of another embodiment of a device

for implementing a first process step.

Figures 1 and 2 show a device for producing a weight-optimized pneumatic tire rim, in the case of which a rim well 1 with rotationally symmetrically partially different wall thicknesses is provided from a cylindrical tube section 1a, preferably made of steel, by means of cold forming, which rim well is subsequently connected, preferably by means of welding, with a rim dish which is not shown.

This device has a tool lining 2 consisting of a first lining part 3 and a second lining part 4, which can be moved in the axial direction relative to one another in a spring-loaded manner.

The surface area of the tool lining 2 is provided with a precontour 5 into the tube section 1 can be correspondingly pressed by means of pressure rollers/rolling tools 8.

Figure 1 shows the start of the process during which the cylindrical tube section 1a rest on the exterior side against the tool lining 2.

Starting from the two end sides of the tube section 1a, by means of the pressure rollers/rolling tools 8, tolerance-caused excess material of a respective defined rotationally symmetrical area forming a flank 6, while leveling the wall thickness S1, is displaced in the area of the well base zone 7 from which, on both sides, the formed flanks 6 extend with the same wall thickness S2. In this case, the well base zone 7 as well as the flanks 6 assume the shape predetermined by the precontour 5.

The tolerance-caused excess material leads to a thickening of the wall thickness S3 of the well base zone 7 with respect to the original wall while, in the area of the flanks 6, the latter is leveled to such an extent that it corresponds, for example, to the lower tolerance measurement.

As an example, a thickness of $3.5^{+}_{-}0.1$ was indicated as the initial wall thickness of the tube cylinder 1a, so that the wall thickness S2 of the flanks 6 is 3.4, while the wall thickness S3 of the well base zone 7 may be approximately 3.85. Here, the leveling of the wall thickness in the area of the flanks 6 has led to a thickening of the well base zone 7 in comparison to the original usage of material.

In order to hold the tube section 1a in the axial direction and in order to prevent that

an axial drawing takes place during the rolling, the first lining part 3 as well as the second lining part 4 have a surrounding stop 9 on which first the tube section 1a and, in the further course of the process, the contoured well base 1 are supported on the end side.

Corresponding to the shortening of the length of the tube section 1a taking place by the precontouring, the second lining part 4 is loaded by means of the spring force until it reaches an end position, as illustrated in Figure 1 by a broken line and as shown in Figure 2.

In the following process step, the flanks 6 are further contoured by drawing toward the outside, as illustrated in Figure 3.

Here, another tool lining 2a is shown whose first and second lining part 3a and 4a respectively, in comparison to the first and second lining part 3 and 4 respectively according to Figures 1 and 2 have a changed and drawn course of the contour 5a.

By means of this device, which has at least one pressure roller/rolling tool 8, the respectively different wall thicknesses of the flanks 6 can be produced.

While a longitudinal drawing is carried out, one of the two flanks 6, starting from the well base zone 7, is changed to a wall thickness S4 by means of the pressure roller/rolling device 8 which presses from the inside toward the outside, which wall thickness may, for example, be 2.6 with reference to the preceding measurement data.

However, the opposite flank 6 is drawn to such an extent that a rotationally symmetrical area with a wall thickness of also S4 = 2.6 and another area with a wall thickness of S5 = 1.8 is obtained within the flank 6.

On the end side, the deformation of the flanks 6 is limited by stops 9a which are provided in a surrounding manner at the first and second lining part 3a and 4a respectively and each form the end of the contour 5a.

The volume, which can be precisely determined beforehand by the leveling of the flanks 6, is again found in the axial dimension, which is greater in comparison, and in the partially reduced wall thickness.

In each case, the height of the rim well 1 and the wall thicknesses of the flanks 6 can be precisely predefined.

In a subsequent further machining of the rim well 1, as illustrated in Figure 4, the end areas of the flanks 6 are finished by shaping rollers 10. In a manner known per se, surrounding ring flanges 11 and humps 12 are shaped on in this case and are used for receiving a tire.

A tool lining 2b is also provided here, which consists of a first lining part 3b and a second lining part 4b, which, on the exterior side, are at least partially shaped to correspond to the contour of the rim well 1.

Figure 5 illustrates that the largest diameter of the lining parts 3, 4 in the machining area or in the contact area with the tube section 1a is larger than the inside diameter of this tube section 1a, so that the tube section 1a, which at first is cylindrical, rests with its end edges against the respectively assigned precontour 5 of the lining parts 3, 4.

During an axial mutual application of the lining parts 3, 4, the end areas of the tube section 1a are in each case deformed to a widening 1b.

As mentioned above, the further machining, that is, the contouring also in the end areas, takes place by means of the pressure rollers / rolling tools 8.

List of Reference Numbers

1	Rim well
1a	tube section
1b	widening
2	tool lining
2a	tool lining
3	first lining part
3a	first lining part
4	second lining part
4a	second lining part
5	precontour
5a	contour
6	flank
7	rim well zone
8	pressure roller / rolling tool
9	stop
9a	stop
10	forming roller
11	rim flange
12	hump